Analysis of Preferred Nesting Area of Grassland Birds in Relation to Tree Lines

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ABSTRACT

Analysis of Preferred Nesting Area of Grassland Birds in Relation to Tree Lines
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There has been a steady decline in the populations of Henslow's Sparrows (*Ammodramus henslowii*), Grasshopper Sparrows (*Ammodramus savannarum*), Bobolinks (*Dolichonyx oryzivorus*), Eastern Meadowlarks (*Sturnella magna*), and Dickcissels (*Spiza americana)* caused by the decrease in grasslands. These grassland birds are area-dependent species, preferring to nest in large, contiguous grasslands. There is research suggesting that grassland birds prefer not live within 50 meters of tree lines. In several of the grasslands at Fermilab, there are groupings of trees that could dramatically decrease the amount of preferred nesting habitat for these birds. The purpose of this study is to determine whether or not the presence of these clusters of trees is detrimental to the populations of these grassland birds. The findings from this study will help the Fermilab Ecological Land Management Committee determine if cutting down these trees to provide a larger nesting area is a feasible option. We randomly walked through the fields and listened for the calls of the Henslow's Sparrows, Grasshopper Sparrows, Bobolinks, Eastern Meadowlarks, and Dickcissels. Once heard, visual confirmation was required, and their Global Positioning System (GPS) location was recorded. These GPS locations were superimposed over a satellite image map of the fields, which allowed us to look for patterns in nesting, specifically at the areas around trees. The average distance the grassland birds were located from a tree is 128 m, with species averages: Bobolinks, 104 m; Dickcissels, 125 m; Eastern Meadowlarks, 72 m; Grasshopper Sparrows, 216 m; and Henslow's Sparrows, 126 m. Using chi-square test for distribution of distances from nearest tree, grassland bird distribution from trees was significantly altered by tress ($p = 4.31 \times 10^{-46}$). The distribution of distances were also significant ($p = 2.8 \times 10^{-5}$ and $p = 2.9 \times 10^{-9}$ respectively); however, Dickcissel and Eastern Meadowlark distributions for Henslow's Sparrows and Bobolinks were not ($p = .13$ and $p = .41$ respectively). Therefore, we suggest removal of trees by cutting based on the statistical significance of our results. This will increase amount of habitable land, causing an increase in population of grassland birds.

INTRODUCTION

Over the past decades, the populations of many grassland bird species, including the Henslow's Sparrow, Grasshopper Sparrow, Bobolink, Eastern Meadowlark, and Dickcissel, have been decreasing. Although these birds are not currently on the Illinois Endangered Species list, they have been listed in previous years, and therefore are still of concern [1], [2]. The main cause for decrease in population sizes has been the "loss and fragmentation of suitable grassland breeding grounds" [3]. Human land usage has changed much of the natural environment into "agriculture and urban development," thus erasing and fragmenting the habitats of these grassland birds [4].

All species are "area-sensitive" species, living mainly in grasslands that are greater than 30 Ha [5], [6]. In addition, Henslow's Sparrows, Grasshopper Sparrows, Bobolinks, and Eastern Meadowlarks are "obligate" grassland species because they need treeless grasslands to live in [7]. A couple of studies have found that predation and parasitism rates in comparison to grassland area are inversely related, which also supports why these grassland birds prefer larger-area grasslands [6], [8]. These birds are area sensitive and obligate to avoid predation, the number one cause of nest failure [5], and brood parasitism, the second greatest cause of nest failure [8].

According to Peter Kasper, the resident bird specialist at Fermilab, the grassland birds in our study have many predators such as the ground squirrels, Eastern Garter Snakes, foxes, coyotes, Loggerhead Shrikes, Cooper's Hawks, northern harriers, American kestrels, and red-tailed hawks [9]. All of the above-listed bird predators are present on Fermilab grounds. Therefore, to avoid predation, grassland birds prefer not nest within 50 m of trees because that is

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where their bird predators live [10], and because there is "greater activity by mid-sized mammalian carnivores in the grasslands within 50 m of forest edges" [11].

These species prefer grassland locations with a high percent of grass and forbs cover, plants that are approximately 45 cm tall, and scattered forbs [12]. Their habitat preference is logical considering grasslands provide enough dense vegetation to increase nest concealment from predators, increasing the likelihood of nest success [4]. In addition to nesting location, Grasshopper Sparrows and Henslow's Sparrows have behaviors that reduce nest predation. One behavior is that they do not directly approach or leave the nest flying; instead, they fly close to the nest and walk the final few meters to avoid their nest being detected by predators. Also, when danger is near, they cease to call and drop down into the grasses [13].

A second cause for nest failure is brood parasitism by birds such as the Brown-headed Cowbird, another bird present on Fermilab grounds [9]. Brown-headed Cowbirds lay their eggs in the nest of a grassland bird, which will then raise it as their own. "Cowbirds thrive along wooded edges," which is another reason why grassland birds will not nest within 50 m of trees [8].

Fermilab's commitment to restoring the native ecosystems includes aiding in the restoration of populations of the Henslow's Sparrows, Grasshopper Sparrows, Bobolinks, Dickcissels, and Eastern Meadowlarks. Besides managing burning of grasslands to accommodate the preferences of the grassland birds for vegetation reducing risk of predation by small mammals, Fermilab's land managers are also considering cutting down trees in the grasslands to increase the amount of habitable land.

In this study, we will determine the distance away from trees within which the grassland birds prefer not to nest; in addition, we will map and determine the uninhabitable area due to the

presence of trees. These results will be presented to Fermilab's Ecological Land Management (ELM) Committee, which focuses its effort on maintaining and restoring the various ecosystems on Fermilab grounds, to provide support for cutting the trees down to provide a larger nesting area for these threatened birds [14].

MATERIALS AND METHODS

The grasslands we are focusing on for the bird study are located in the center of Fermilab; they are the North Eola Road and the South Eola Road grasslands. North Eola Road Grassland is split by Eola Road, into what we called N.E. Eola Road and N.W. Eola Road. N.E. Eola Road Grassland is 38.4 Ha, and N.W. Eola Road Grassland is 33.1 Ha [15]. The South Eola Road Grassland covers 138 Ha. All together, we were conducting our study within a 209.5 Ha grassland, which is larger than the minimum area requirements of grassland birds in question [6]. Present in these grasslands are the plants and vegetation that grassland birds prefer [14].

For several days, between roughly 6:45 AM and 9:30 AM while the birds are most active, we randomly walked the fields. After studying the calls of the Dickcissel, Eastern Meadowlark, Bobolink, Grasshopper Sparrow and Henslow's Sparrow [16], we listened for the calls of the birds. When one of the birds was heard, we gained visual confirmation by identifying physical features [17] of the birds and by seeing the bird make its call. When the bird was confirmed, we walked over to its spotted location, and recorded the GPS coordinates, along with field, date, species, and bird number. We then began to randomly walk until another call was heard and followed the same procedure. Each field was visited twice during the research.

We then created an Excel file of the GPS coordinates, bird number, species, and field, and then used Google Earth to map each bird. Once mapped, each bird was thumbtacked with a color and label associating it to the species. We also used Google Earth to calculate the area of

the fields and to measure distances between a bird and the nearest tree. Roads and cropland were not taken into account because there is research supporting that they do not affect grassland bird nesting preferences [5]. In addition, dead trees were not taken into account because grassland birds would not respond the same way to the tree; according to Peter Kasper, predators perched in a dead tree could easily be seen and avoided by grassland birds [9]. Using Random.org, 50 random locations in the fields were generated to provide us with expected locations and distance away from trees that were used to complete a chi-square test of the data [18].

RESULTS

The null hypothesis for the research is that tree lines have no effect on nesting locations of grassland birds; grassland bird locations should be randomly distributed throughout the grasslands. We used the chi-square test to compare random expected distances away from trees to actual distances of the birds. The results are as follow:

Figures 1 and 7 compare Bobolink and Henslow's Sparrow distributions from trees to the expected distributions shown in Figures 2 and 8. According to the chi-square tests, Bobolink and Henslow's Sparrow distributions were significantly different from that of the expected ($p=2.9x10^{-9}$ and $p=2.8x10^{-5}$ respectively). This suggests that tree lines greatly affect nesting locations of Bobolinks and Henslow's Sparrows in grasslands.

Figures 2 and 5 compare Dickcissel and Eastern Meadowlark distributions from trees to the expected distributions shown in Figures 4 and 6. According to the chi-square tests, Dickcissel and Eastern Meadowlark distributions were not significantly different from that of the expected ($p=.13$ and $p=.41$ respectively). This suggests that nesting locations of Dickcissels and Eastern Meadowlarks are not influenced by tree lines.

No chi-square test was conducted for the Grasshopper Sparrow distribution of distances because of their low observed population. However, Grasshopper Sparrow distribution was calculated into chi-square test of all observed grassland bird distribution. Overall, distribution of birds was significantly different than expected ($p = 4.31 \times 10^{-46}$), shown in Figures 9 and 10, indicating tree lines affect nesting location preferences of grassland birds.

Looking at Figure 11, Bobolinks, on average, preferred not to be within 104 meters of trees. Dickcissels and Henslow's Sparrows prefer to remain further away: 125 m and 126 m respectively. Grasshopper Sparrows remain ever further, staying on average 215 m from trees. Eastern Meadowlarks, however, were found as close at 72 m to trees. These five grassland birds were found, on average, at 128 m from trees.

Systematic Error

Our initial assumption was that all the fields contained similar preferred vegetation. However, when we walked the fields, we realized that sections of the field had vegetation that was unsuitable to support the birds we were studying. While we walked each field twice to reduce this error, there is still a chance that we missed some areas within a field. The GPS locations recorded could be incorrect because of the error of the equipment. Lastly, there is also a chance of error associated with measuring areas and distances when using Google Earth.

No literature could be found about the effects of bodies of water and dead trees on nesting preferences. Located in the South Eola Road Grasslands are three dead trees, a river, and a lake. It is unknown if these affected nesting preferences. Further research needs to be done focusing on these possible factors.

DISCUSSION AND CONCLUSIONS

As evidenced by the data, grassland birds are affected by tree lines, preferring not to live close. Instead, they will remain outside of an imaginary ring of a certain distance. This distance is different for each of the birds: 72 m for Eastern Meadowlarks, 104 m for Bobolinks, 125 m for Dickcissels, 126 m for Henslow's Sparrows, and 215 m for Grasshopper Sparrows. The large distance the Grasshopper Sparrows prefer to stay away from trees might be a possible cause for their low population on Fermilab grounds. Another cause for low amounts of Grasshopper Sparrows could be the vegetation; the three Grasshopper Sparrows were spotted in the same area of similar vegetation of tall grass with minimal forbs that is not present in other parts of the grasslands.

There are several birds found within the average distances and the 50 m as supported by other research. All five grassland birds are territorial, which means they will nest away from another couple [13], [19], [20]. Birds might choose to live closer to trees than preferred to have more territory space. With that being said, statistical analysis does show that many birds prefer to stay away from the trees.

The distribution of distances for all birds, as well as the Henslow's Sparrow and Bobolink were statistically significant, indicating their distribution throughout the field is affected to avoid tree lines. Using Google Earth and the average distance that grassland birds at Fermilab prefer not reside within, we were able to approximate the area of preferred nesting habitat that is lost by trees. Looking solely at the North Eola Road fields, the grasslands determined most eligible for restoration of grassland vegetation, the area lost by tree interference with nesting is 40.45 Ha, more than half of the entire field area. Only 31.05 Ha remains preferred nesting area for grassland birds, which is below the minimum field size for habitation by

Bobolinks and Henslow's Sparrows, but above the minimum for those of Eastern Meadowlarks and Grasshopper Sparrows [6].

Since the results were statistically significant, it is reasonable to conclude that a decrease in trees will result in an increase of habitable grassland. We would recommend the cutting of clumps of trees, beginning with the four larger clumps of trees located completely within the grassland. If all the eligible trees were cut, it would increase habitable area by 21%, increasing amount of preferred, habitable grassland to 48.35 Ha, which is closer to the minimum field size of Henslow's Sparrows and Bobolinks for solely the North Eola Road grassland.

By cutting trees we hope to expand the amount of preferred habitat for all grassland, thus increasing the likelihood that they will choose Fermilab as their nesting ground and their chance for nest success, eventually leading to larger grassland bird populations. However, tree cutting should be done carefully. Before cutting, an inventory of birds living in those trees should be taken to weigh all the advantages and disadvantages to all species affected by the cutting of the trees.

ACKNOWLEDGEMENTS

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FIGURES

Boblink Frequency
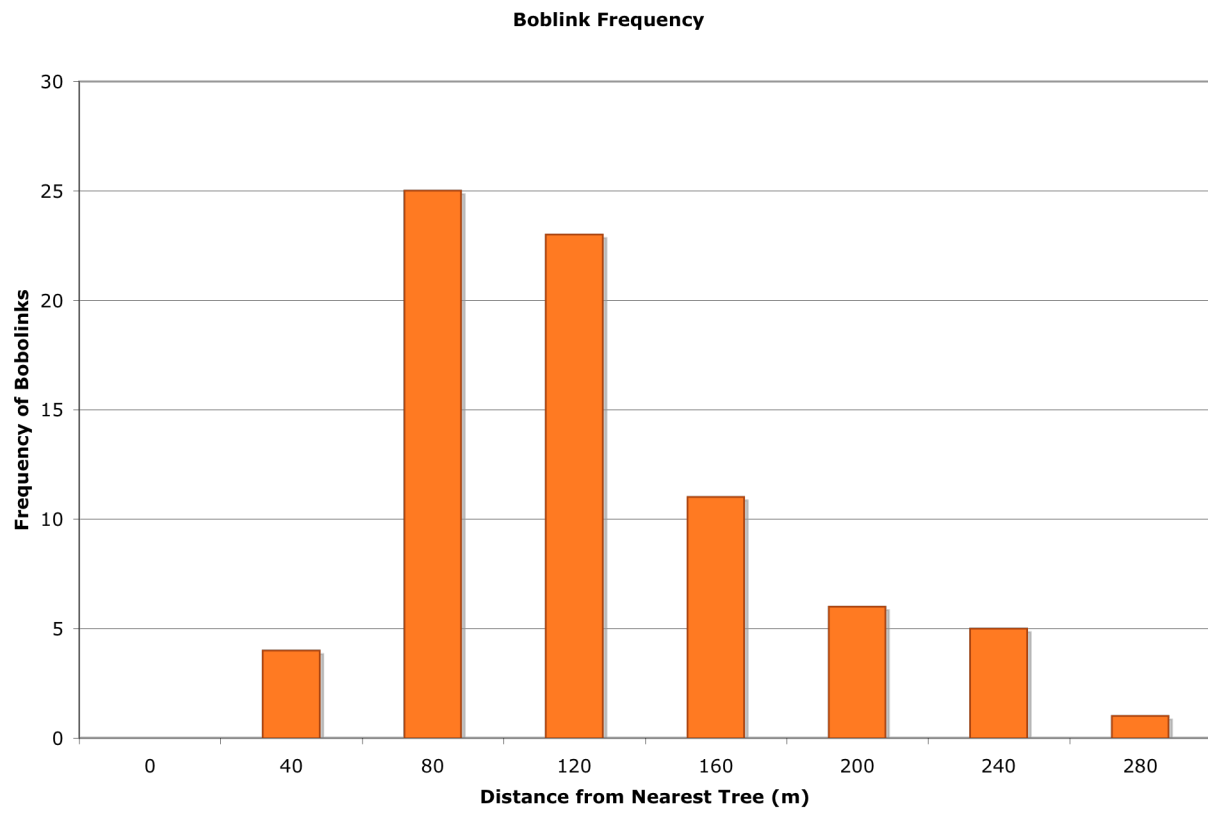
Figure 1: Distribution of distances from nearest tree of Bobolinks.
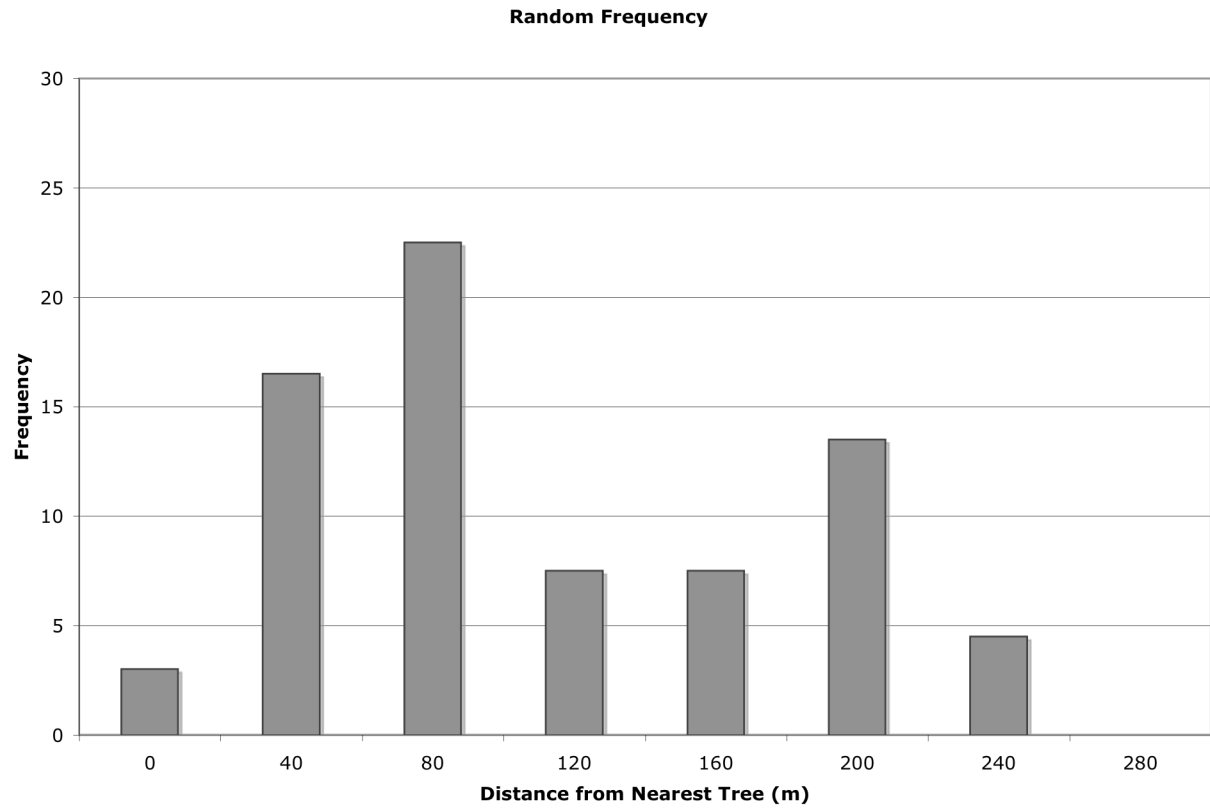
Figure 2: Distribution of distances from nearest tree of random locations.
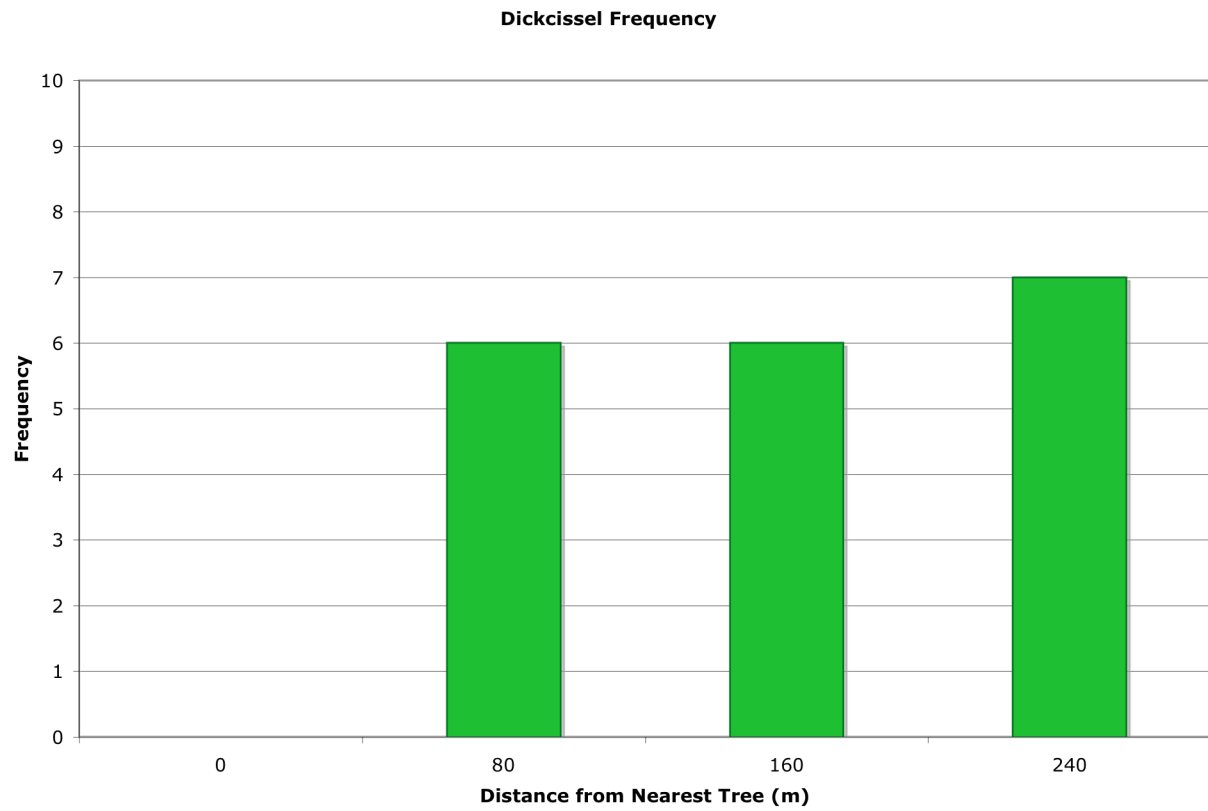
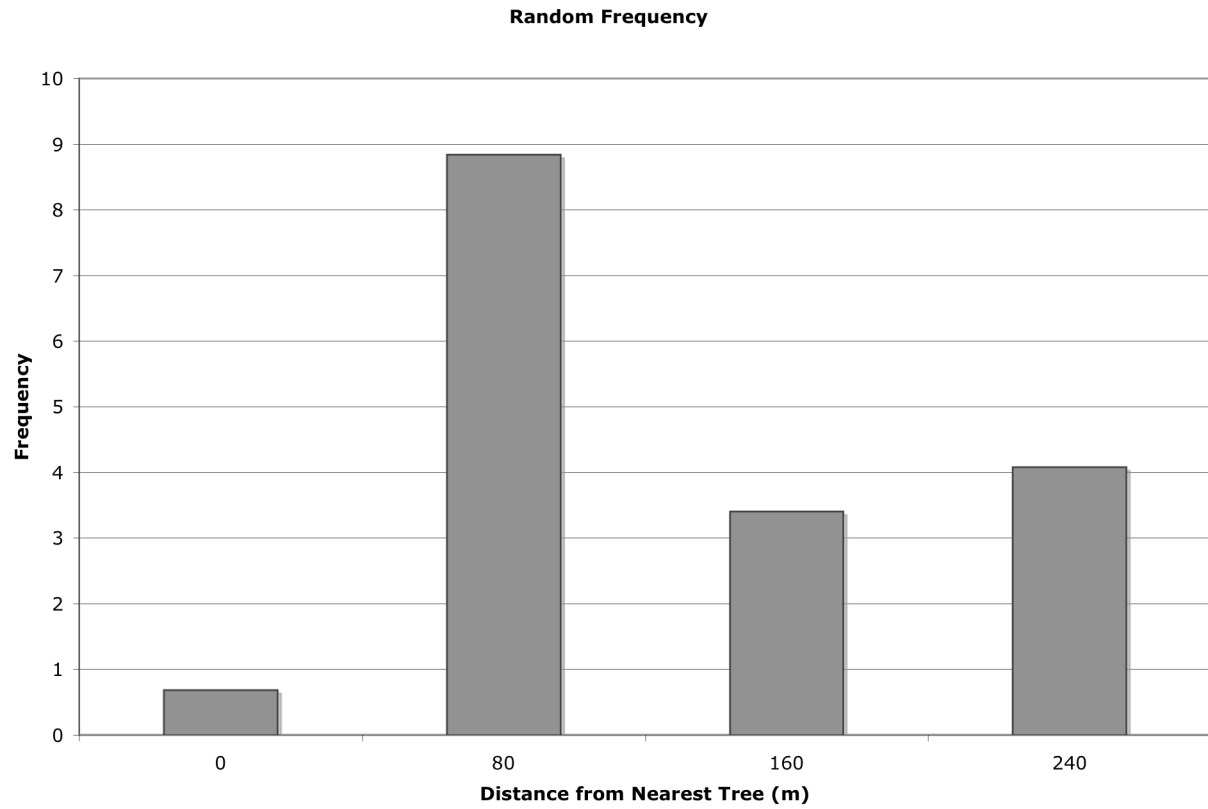Figure 3: Distribution of distances from nearest tree of Dickcissels.

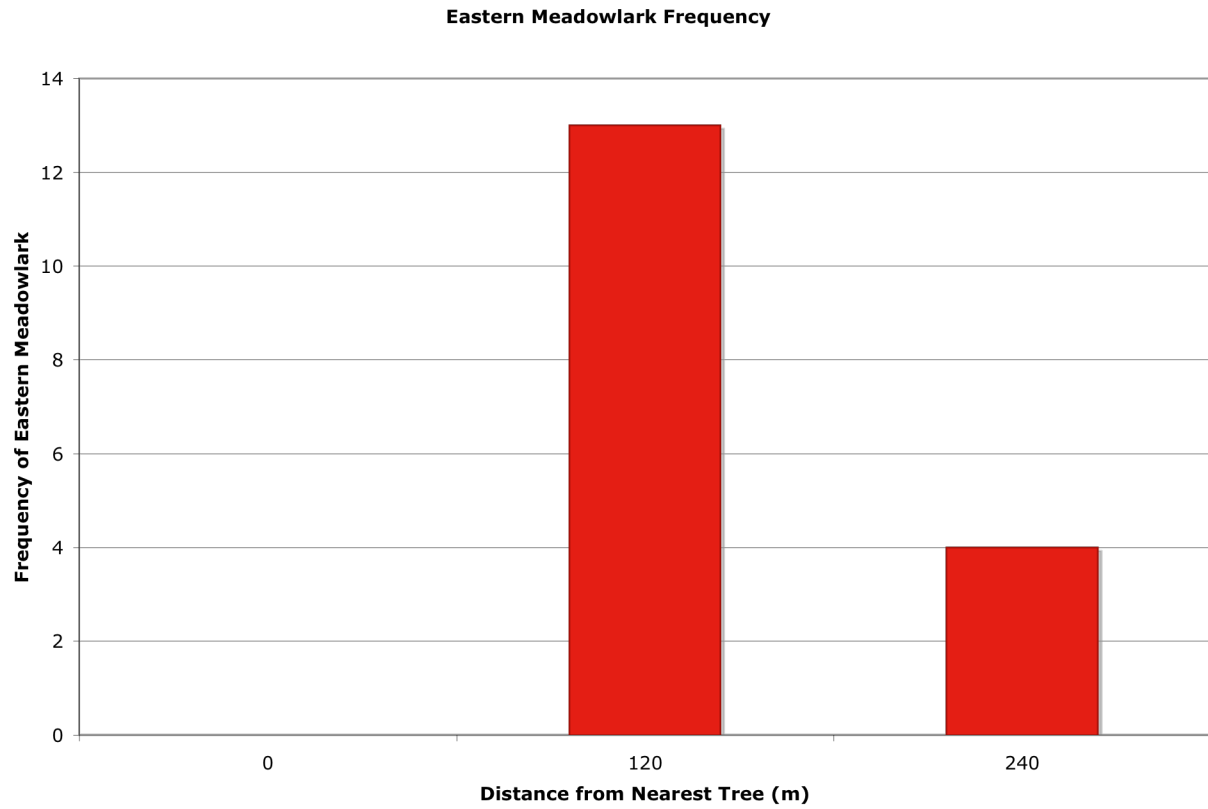Figure 4: Distribution of distances from nearest tree of random locations.

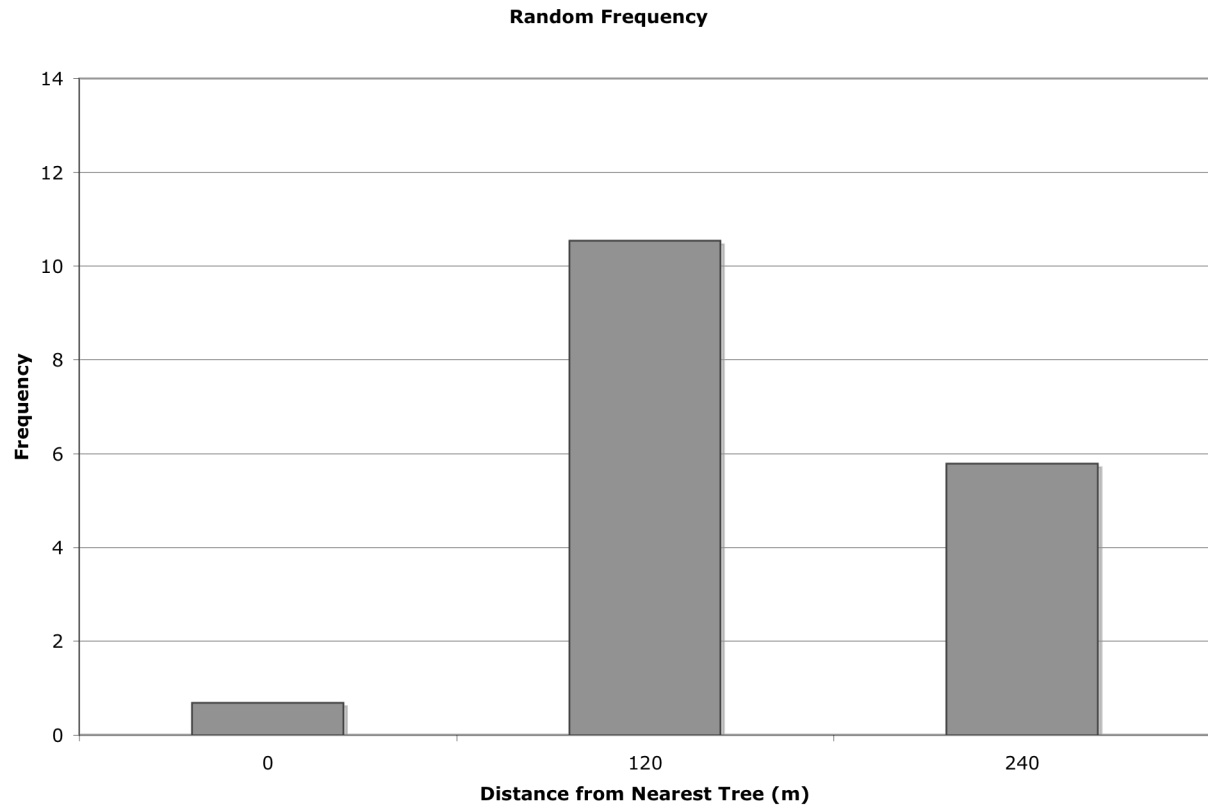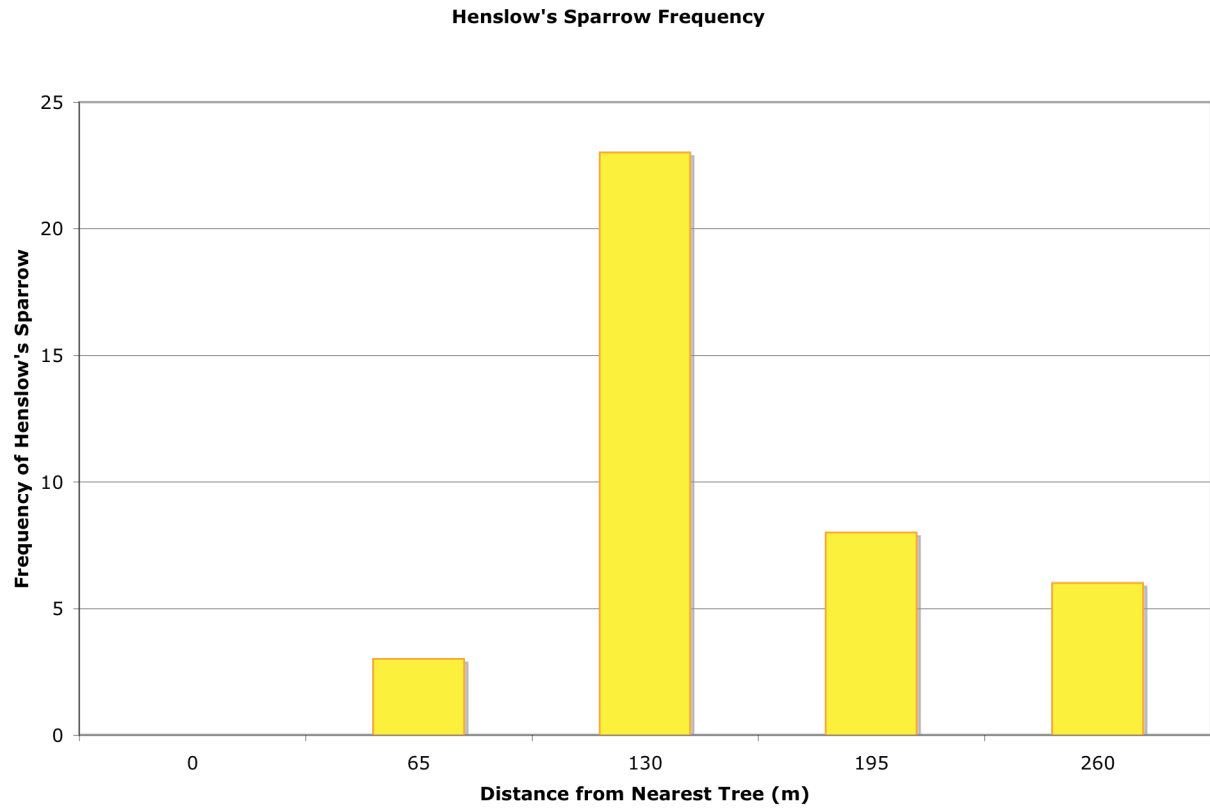Figure 5: Distribution of distances from nearest tree of Eastern Meadowlarks.

Figure 6: Distribution of distances from nearest tree of random locations.

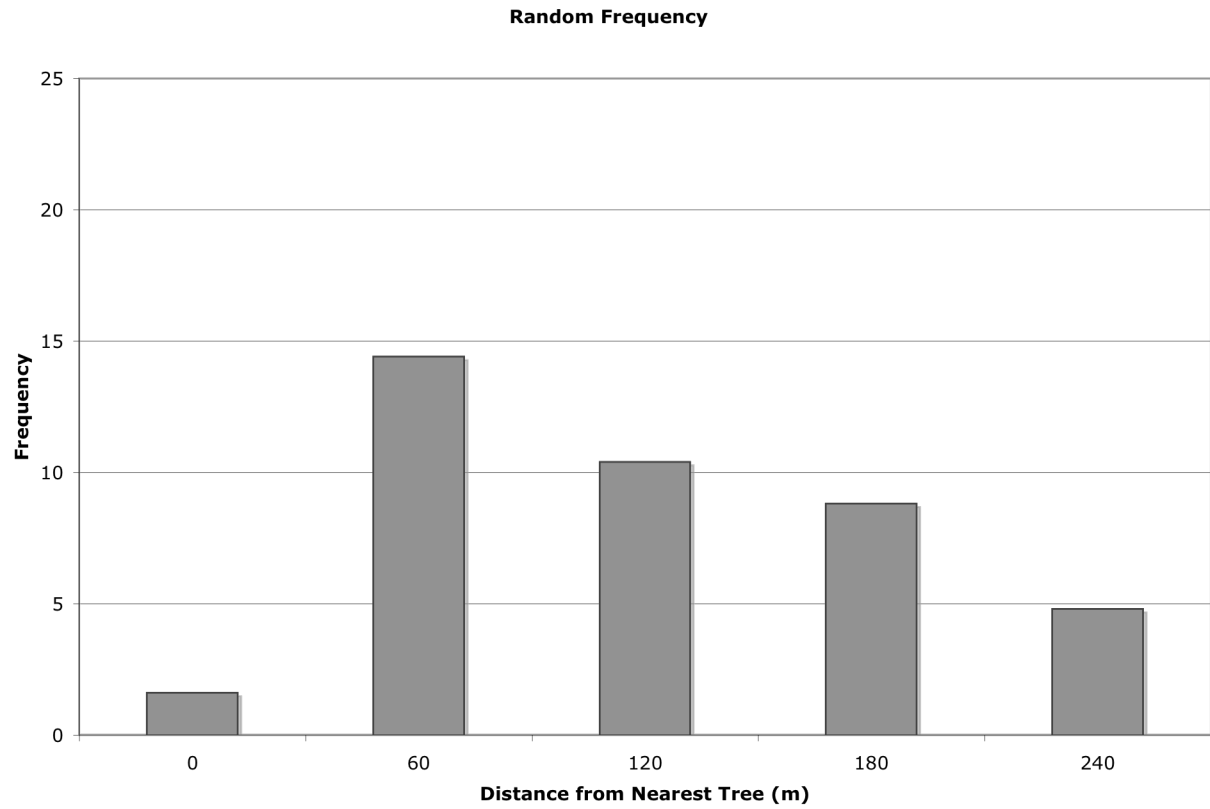Figure 7: Distribution of distances from nearest tree of Henslow's Sparrows.

Figure 8: Distribution of distances from nearest tree of random locations.
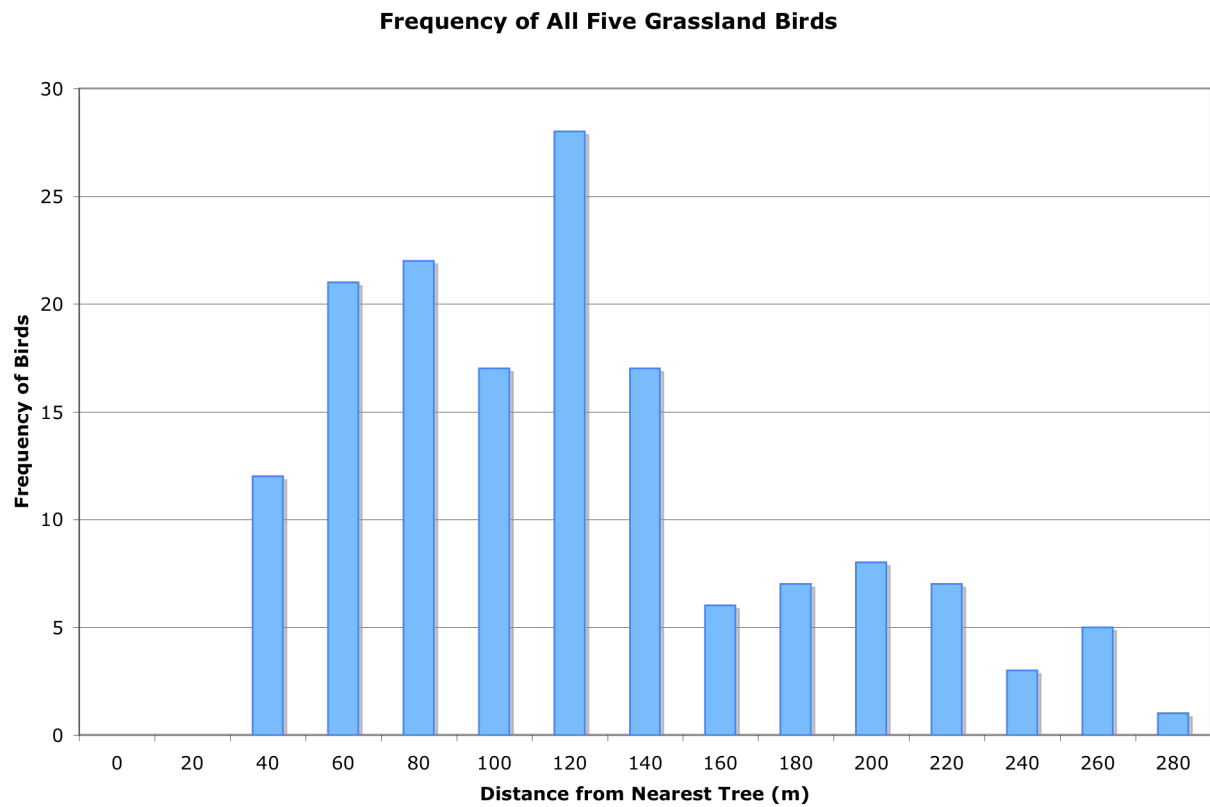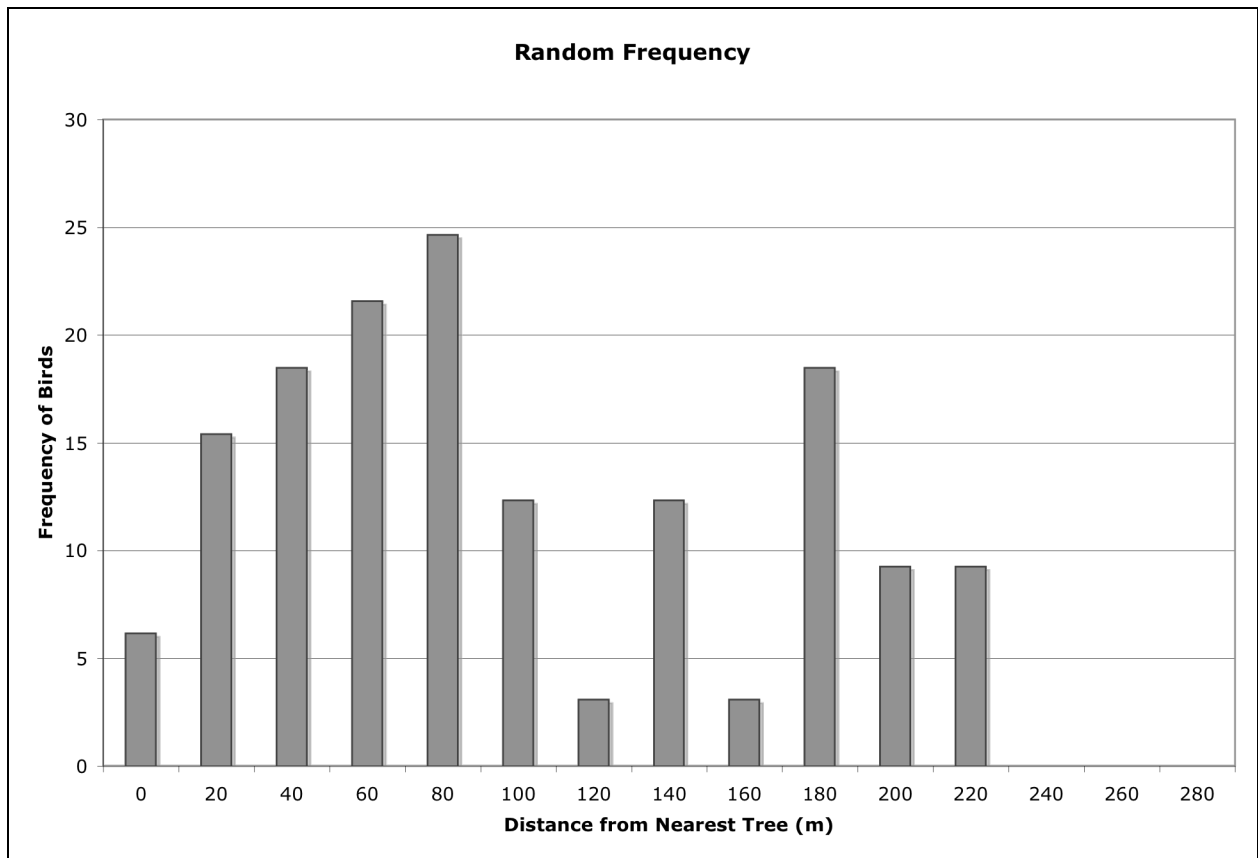
Frequency of All Five Grassland Birds

Figure 9: Distribution of distances from nearest tree of the five grassland birds.

Figure 10: Distribution of distances from nearest tree of random locations.
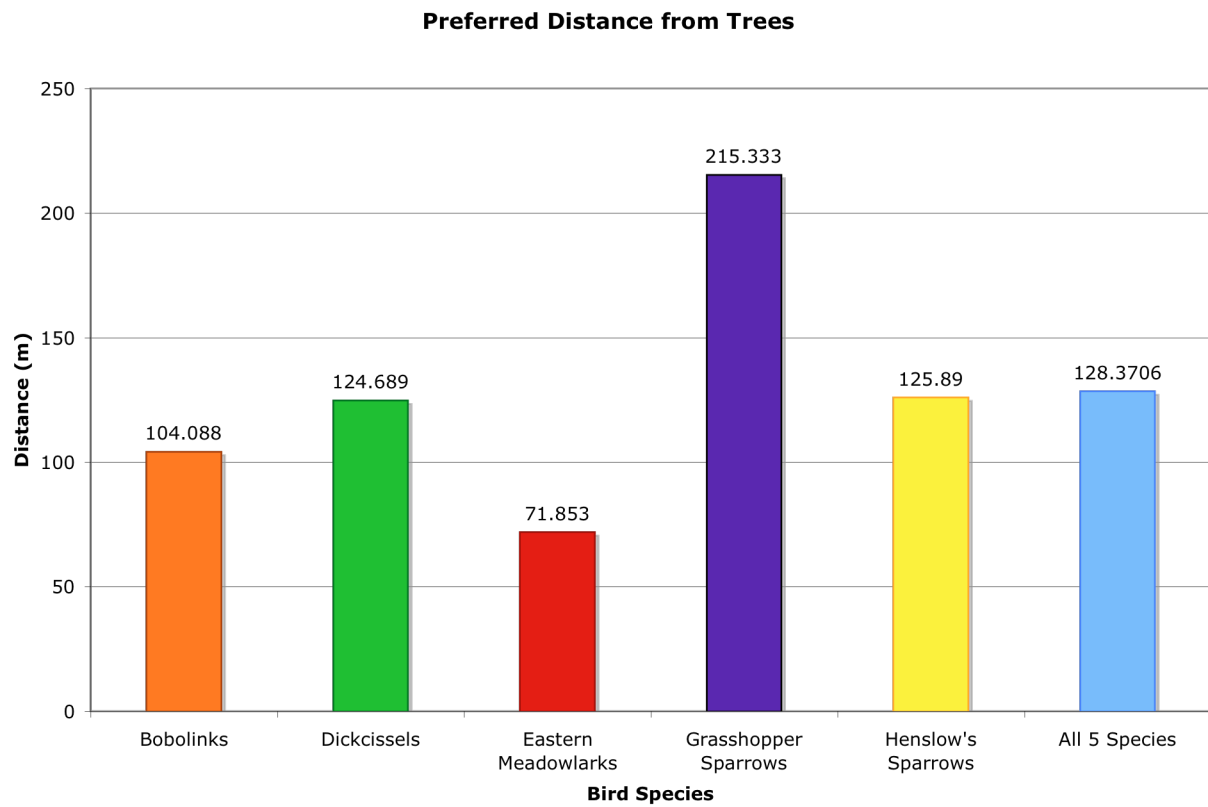
Preferred Distance from Trees

Figure 11: Average distance from nearest tree of the grassland birds.